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AUTHOR Powers, Susan M.
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ABSTRACT

An analysis of language acquisition in English and Dutch focuses on a theory of phrase structure. It is argued that the previously posited phrase structure operations of projection and adjunction can be dispensed with in favor of the single operation of "merge." One version of merge is shown to account for a range of data from child English and child Dutch. It is also proposed that the phrase structure possibilities this version yields also account for previously reported but unsolved syntactic puzzles in child language and for adult uses of lexical items. The primary finding is that merge is, both conceptually and empirically, a more parsimonious operation; a single operation facilitates the mapping of phrase markers to children's earliest utterances. Contains 14 references. (Author/MSE)

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MAPping Phrase Markers*

Susan M. Powers, University of Potsdam

This paper considers the advantages of dispensing with the previous phrase structure operations of Projection and Adjunction in favor of the single operation of Merge (Chomsky 1995). The version of Merge developed by Roeper (1995) for language acquisition is shown to quite elegantly account for a range of data from child English and child Dutch. The phrase structure possibilities this version of Merge yields also account for previously reported but unsolved syntactic puzzles in child language. The main finding is that Merge is more parsimonious both conceptually and empirically. That is, this single syntactic operation considerably facilitates the mapping of phrase markers to children's earliest utterances.

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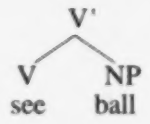
1. Introduction

1.1 Phrase Markers

The focus of this paper is the phrase marker representations of children's early utterances. A phrase marker is a structural description (SD) of an utterance. A possible phrase marker for the child utterance 'see ball' is in 1 below .

1.



According to Speas (1990) "Underlying structures are projected from strings of lexical entries. This means that **every string of words** has associated with it a phrase marker [my emphasis]." Assuming the same for children, all child utterances have a underlying syntactic structure (a phrase marker).[1]

1.2 MAPping

In the traditional sense, mapping means associating a particular child utterance with a particular phrase marker. MAPping is also an acronym for three syntactic operations which create syntactic structures: **M**erger, **A**djunction and **P**rojection. Adjunction and Projection will be discussed briefly in Section 2 below and in the remainder of the paper, I discuss Merge. As Merge subsumes both projection and adjunction, I argue that Merge alone is sufficient for mapping phrase markers onto children's utterances.

2. Projection and Adjunction

Formal versions of X-bar theory (Jackendoff 1977, Chomsky 1986) specify three bar-levels of representation (X^0, X' and XP) and state well-formedness conditions on phrase markers.

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*I would like to thank Peter Jordens and Jacqueline vanKampen for making their diary data available to me. In addition, I thank the audience of GALA 1995 for comments and suggestions and Tom Roeper for hours of discussion.

[1]This is not a trivial assumption (cf. semantically based theories of children's early speech in which no phrase marker at all is postulated for child speech Braine (1976)).

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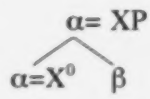
2.1 Project ∝

According to Speas, the single operation of Project α (in 2 below) embodies all the conditions and restrictions on X-bar theory.[2]

2. Project Alpha: a word of syntactic category X is dominated by an uninterrupted sequence of X nodes (Speas 1990)

This operation creates a phrase marker by taking a word of syntactic category α and projecting it to XP (as in 3 below).

3.

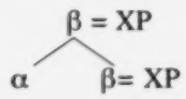


In this phrase marker, the head α projects to give the label to XP and β is the complement.

2.2 Adjunction

Following Chomsky (1981) "..there is only one kind of adjunction, namely, preserving the categorial structure of the phrase to which the element is adjoined..." as in 4 below where β is the category which has been adjoined to and α is the adjunct.

4.



In this configuration, β can only be maximal (i.e. an XP) as there is a prohibition on adjoining to heads (Chomsky 1986).

2.3 Adjunction versus Projection

The relation of the lexical items α or β to the maximal projection (XP) differs depending on whether the phrase marker is formed by Adjunction or Projection. According Lebeaux (1988) the difference is "The argument-of relation holds in a pure way within each structure (i.e. the subject-of, object-of, or prepositional-object-of is purely instantiated), but the relation of adjunct-of holds between structures. In addition, one substructure is specially picked out as the root." Phrase markers (XPs) formed through projection have argument slots while those formed by adjunction do not have any pre-specified structural relation prior to the adjunction operation.

2.4 Conceptual and Empirical Shortcomings

Projection and/or adjunction can yield phrase markers for many of children's early multi-word utterances and the additional adoption of some ancillary assumptions about the initial state of the phrase marker (e.g. functional categories or operations like adjunction are not available); makes strong predictions about the transition to the adult phrase marker.[3] There are at least two problems with these operations. The first is conceptual: often more than one phrase marker is compatible with a given utterance.[4] The second problem is empirical: truly novel child utterances are often not amenable to the phrase structure representations projection and

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[2]See Lebeaux (1988) for a completely different version of Project ∝ in language acquisition.

[3]For example, Radford (1990) claims that the transition from a lexical stage (lacking functional projections altogether) to a stage where the child's representation includes all adult functional projections, is manifested by the a number of grammatical constructs (e.g. pronouns, determiners, inflected verbs) which appear simultaneously in the child's productive repertoire (cf. Guilfoyle & Noonan, 1992).

[4]Powers (1996) calls this the Problem of Too Many Trees or TMT.

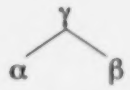
adjunction provide. While Merge does not resolve the former problem providing two possible labels for any projection; the biggest advantage of Roeper's version of Merge is that even novel child productions have a fixed structural description which is semantically defined. This is further explicated in Section 3 below.

3. The Operation Merge

Chomsky (1995) defines the operation of Merge roughly as in 5 below:

5. Merge: Applied to two objects α and β (each a lexical item = a set of features) create a new object (a phrase marker) call it β

6.



In 6 above, α and β have been Merged into the phrase maker γ.

There are at least three ways in which Merge contrasts with X-bar Theory. First of all, there is no explicit reference to levels of hierarchical structure (i.e. levels X^0, X' and XP) because in fact, there are no intermediate levels of hierarchical structure. The structure in 6 above is maximal.

Secondly, there is no a priori specification of the node label of γ which is called σ, in relation to another node in the tree. In X-bar theory for example, XP is defined as the maximal projection of the head X^0. According to Chomsky (1995) "The label σ is either α or β; one or the other *projects* and is the *head* of γ". This contrasts with previous theories (e.g. Stowell (1981)) in which the head term was explicitly defined.[5] As there is no extrinsically defined hierarchical structure, there is no need to define the head of a phrase.

The third way in which Merge differs from projection, is that α and β (as in 6) are not lexical categories (i.e. N, V, A, P) per se, but sets of features. This conception of lexical items is the most important difference for the version of Merge proposed by Roeper for language acquisition to which we now turn.

3.1 Merge and UMPs

Roeper (1995) argues that Merge is the only structure building operation in children's grammars. His version of Merge is identical to Chomsky's version in all respects but one namely: the feature matrix of α or β can be underspecified or incomplete. As such, this underspecified feature matrix can project to the node label β. thus "The child projects Unique Maximal Projections (UMPs) not (necessarily) found in the adult grammar" (Roeper 1995). It is the underspecification of features which renders the node label β *unique* vis-à-vis the adult grammar; as in the adult grammar, the feature matrices of β or β are fully specified.

3.2 An Example of a Unique Maximal Projection (UMP)

According to Roper, merge structures can "capture neglected moments in acquisition." Consider the language acquisition data from Davis (1987) below.[6]

7. are you put this on me?
   are you get this down?
   are you want one?

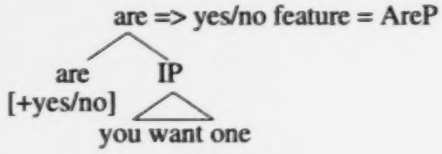
---

[5] "The head term is one bar level lower that the immediately dominating phrasal node" (Stowell 1981).

[6] Actually the data which are reprinted in Davis (1987) come from a talk at UBC by C. Johnson in 1983.

Even though these data are clearly child-invented, the adult model is obvious. Roeper argues that the child's novel use in 7 above reflects the encoding of a certain feature of the word *are* (i.e. the fact that *are* often appears at the left periphery of questions). Roper claims that the UMP in 8 (a merge structure) most accurately captures the child's knowledge of at least one feature (this question feature) of the lexical item *are*.

8.



This is a *unique* maximal projection because this phrase marker does not exist in the adult grammar; at least not as an AreP. This phrase marker could be viewed as a precursor to the adult category CP which contains a propositional/illocutionary force marker (i.e. [+ interrogative]).[7] In the words of Roeper: "The crucial point here is that the representation of this form -- which carries the illocutionary force linked to CP -- is limited to a single lexical item." That is, the child identifies the feature [+ interrogative] with the word *are*.

3.3 Two Consequences of Underspecification

One of the major consequences of the projection of an underspecified feature matrix (as noted by Roeper) is the possibility of an **infinite set** of possible phrase markers. For example, in 7 above, it is the [+yes/no] feature of *are* that the child encodes. This single feature of the word projects and defines a projection which is not found in the adult grammar (e.g. an AreP). By logical extension, every word could have its own projection. Thus, making the set of projections infinite.

The set of possible phrase markers is not truly infinite because some features are not encoded by language. As such, we would not expect the child to encode semantic features which adults do not. In addition, not all utterances that children produce warrant the formation of a UMP as the features of some words (i.e. nouns) seem to be fixed rather early.[8] Let's assume that the U of a UMP signifies **u**nderspecified which in turn, renders these projections **u**nique. That is, for some lexical items, the feature matrix is underspecified: only a subset of features are recognized by the child. The projection of this underspecified feature matrix to the node label creates a unique maximal projection (UMP).

The second result of an initially underspecified representation, is the transition to the adult phrase marker. Roeper claims that development consists of adding features of lexical items "It is the projection of formal features, instead of category labels, that **defines and then revises** each projection [my emphasis]." As the child adds features to lexical items, the corresponding node label is changed accordingly. The child progresses from a set of UMPs (underspecified and hence unique) maximal projections which then become more specified and in due course, compatible with the set of adult maximal projections (AMPs). This contrasts starkly with the view that the child's initial phrase markers consists of a subset of the AMPs (i.e. only the lexical projections Radford (1990)). What underspecification of maximal projections means is that in fact initially the child's phrase marker system is a superset of projections which then become more specific and eventually, identical to the set of AMPs.

4. Evidence for UMPs

Roeper supports his idea that at least some of children's initial syntactic structures are unique with two types of acquisition evidence: Novel uses of adult lexical items and Novel lexical items in adult uses. I discuss below how UMPs easily and elegantly account for this data.

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[7]This analysis is also compatible with Valian, Lasser & Mandelbaum (1992) who propose that all utterances are a QuesP projection which a CP complement by assuming that AreP is a pre-cursor of QuesP.

[8]According to Roeper, these data are accommodated by a regular instance of Merge where the respective parts of the phrase marker are fully specified the feature matrices.

4.1 Novel Uses of Adult Lexical Items

In addition to the cases where a question word (e.g. *are*) appears in initial position in children's early questions, there are also a number of other instances of novel (or unadult) uses of adult lexical items which suggest that children may be sensitive to just one feature of a particular lexical item.

Positional Productive Patterns
Braine (1976) gives several examples of what he calls Positional Productive Patterns (PPPs). Similar to the utterances in 7 above, these utterances are clearly innovations. The second property of PPPs which is more crucial for the discussion here, is the observed positional consistency. Consider the data in 9 and 10 below.

9.
no bed
no home
no mama
no wet
no high
no fix
no plug
no water
no pee
no more
no down

10.
more hot
more car
more cereal
more read
more sing
more high
more walk

In addition to positional stability, the items *more* and *no* also have a stable semantics reflecting recurrence and denial respectively. Similar to the *are* examples in 7 above, the child's innovations arguably reflect a sensitivity to certain features of these lexical items.

4.2 PPPs as UMPs

Each Positional Productive Pattern or PPP can be straightforwardly accounted for by a UMP in which the feature of *no* or *more* gives it label to the projection and its complement is constituted by members of any number of categories (e.g. V, N, A, or P).

11.

α = {no, more}

α	β	
no	V(P)	pee, read
more	N(P)	plug, car
	A(P)	hot, high
	P(P)	down

The advantage of assigning these utterances a UMP is that a property of the lexical items themselves (i.e. *are*, *no*, *more*) characterizes the projections. In this way, the semantic or illocutionary import of the lexical item is key in defining the syntactic structure. Under X-bar Theory, these lexical items would most likely have occupied a specifier position; thereby not effecting the label of the projection at all.

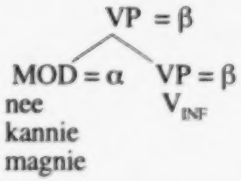
4.3 Novel Lexical Items

Hoekstra & Jordens (1991) report some novel lexical items found in child Dutch which similarly reflect positional and semantic consistency. The child they followed used a number of novel lexical items in pre-VP position. One of these items, is the adult anaphoric negator *nee* (equivalent to English 'no') which is used to express modal negation by the child.[9] Interestingly, the child creates two novel lexical items which consist of an auxiliary verb (i.e. *mag* 'may' or *kan* 'can') and the negator *niet* 'not' (truncated to *nie*) as in 12 below.[10]

12. kannie = can+not
    magnie= may+not

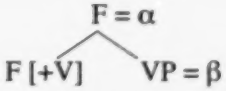
Hoekstra & Jordens analyze these novel lexical items as VP adjuncts as in 13 below

13.



According to Hoekstra & Jordens, these modal-like elements are initially adjoined to the VP phrase marker (as in 13 above) and are subsequently re-analyzed as heads.[11] Only when the child correctly analyzes these elements as modals and negation (i.e. elements which have a head complement structure) can the child project the correct representation. After the reanalysis, Hoekstra & Jordens claim that the child's phrase marker will be the one in (14) below (where VP is a complement to the Functional head F which has a verbal feature [+V]).

14.



The addition of the feature [+V] is crucial in redefining the label of the projection. The two alternative phrase markers provided under Merge (i.e. either α or β projects) correspond exactly to the two acquisition stages Hoekstra & Jordens argue for. That is, first β projects (as in 13), then after the child correctly analyzes modals and negation, α projects (as in 14).

5. Advantages of Merge

5.1 Conceptual Simplicity

Merge is both simpler and more powerful than previous phrase structure operations. Even a generalized notion of projection (i.e. Project-α in (2 above)) still needs to refer explicitly to the head term and well-formedness conditions on projections.[12] Merge subsumes both projection and adjunction: if α is the head, α^{MAX} is the label of γ as in (15) whereas if the label of γ is β as in (16), this is equivalent to Chomsky-adjoining a constituent to β

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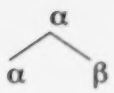
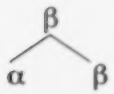
[9]This is similar to the interpretation of the PPPs with no+X in 9 above. For example, 'no plug' means 'I mustn't touch the plug'.

[10]In addition, the child uses other completely new lexical items (i.e. 'hunnie', 'minnie') in the same way. Although interesting in their own right, I focus here on the lexical items which are easily decomposable into their adult counterparts.

[11]The original suggestion that adjunction is the default operation in acquisition comes from Voss (1990).

[12]Or on projection chains (see Speas 1990).

15.  = Projection

16.  = Adjunction

Merge is thus a simplification eliminating the need for X-bar theory altogether. In the words of Chomsky (1995) "Standard X-bar Theory is thus largely eliminated in favor of bare essentials." In addition, other phrase structure operations like adjunction (and their accompanying restrictions) are superfluous. The operation of Merge is an advantage over Projection and Adjunction for acquisition data because any string of words will have a structural description independent of the child's knowledge of all the categorial features and the phrase structural status (e.g. X^0 or X^{MAX}) of a given lexical item

5.2 Empirical Coverage

The great empirical advantage of Merge is the unambiguous analysis of children's novel utterances which are potentially compatible with a number of different X-bar phrase markers. Merge makes the mapping between the semantic and the syntactic component transparent -- the phrase marker is defined by the words of which it is composed; even if, these reflect a novel use or are in fact novel lexical items.

6. UMPs and AMPs

All of the cases of UMPs heretofore considered have been words which appear on the periphery of children's utterances. The issue of how to integrate UMPs and adult maximal projections (AMPs) arises again in cases where the child uses an adult lexical item in a non-peripheral position. These cases are considered below.

6.1 Novel Modality Markers

AUCH as verb
Tracy, Penner and Weissenborn (1993) report a very interesting acquisition sequence in child German and Bernese Swiss German. Children first use the lexical item *auch* 'also, too' in a peripheral position (e.g. *Ich auch* 'I too'); this is followed by a second stage in which *auch* is in complementary distribution with finite verbs as in 17 below.[13]

17. a. ich auch Milch. 'I also milk'
    b. ich auch Milch haben. 'I also milk have$_{INF}$'

Following Tracy, Penner and Weissenborn's suggestion that the child is using *auch* as verb,[14] Roeper proposes that the child assigns a verbal feature [+V] to *auch* which projects to the node label β, thus creating a UMP.

OOK as a Finite Verb
Interestingly, the same pattern that Penner, Tracy & Weissenborn reported for child German is attested in child Dutch. This pattern is very well documented in Laura's diary data from Jacqueline vanKampen. The Dutch equivalent *ook* 'also, too' appears with infinitives as in 18a and b below and also replaces finite verbs entirely as in 19a and b.

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[13]Other patterns involving adverbs and direct objects are also attested at this second stage of *auch* use. See Penner, Tracy and Weissenborn 1993 for details.

[14]This mis-analysis is quite plausible as 17a is a perfectly well-formed adult German utterance in ellipses environments.

18.	a.	pappa ook zitten $_{INF}$ daar.	'Daddy also to.sit there'	Laura 2;0.28
	b.	pappa ook eten $_{INF}$.	'Daddy also to.eat'	Laura 2;0.28
19.	a.	ik ook sokke uit .	'I also socks out/off'	Laura 2;0.29
	b.	mamma ook sokke uit .	'Mamma also sock out/off'	Laura 2;0.29

vanKampen notes that Laura uses *ook* in the context of *wil* 'want' (in 20a and b below).[15]

20.	a.	ik ook pen mij .	I want pen (of) me	Laura 2;1.2
	b.	ik ook bal mij .	I want ball (of) me	Laura 2;1.2

In addition, Laura uses *ikke* (the emphatic form of the nominative first person pronoun 'I') as a verbal form which is equivalent to 'I want' as in 21a and b below.[16]

21.	a.	ikke saap, niet he?	I_{EMP} (want) sleep, not huh	Laura 2;1.9
	b.	ikke pop hebbe.	I_{EMP} (want) pop $have_{INF}$	Laura 2;1.9

This analysis of is supported by cases of *ikke* which occur without verbs as in 22 below (from Powers (1994)).

22.	ikke sokken.	I_{EMP} socks	Laura 2;0.5
	ikke auto.	I_{EMP} car	Hein 2;4.16
	ikke chocola.	I_{EMP} chocolate	Niek 3;0.9

If at this point in development, both *ikke* and *ik+ook* mean 'I want', then we predict that both forms: *ikke+ook*. will not occur. This prediction is borne out as the sequence *ikke+ook* is attested both before and after this period of novel use, but crucially not when each these forms have the meaning 'I want'.

6.2 Applying Merge - UMPs Revisited

I claim that *ook* is being used as novel modality marker which is adjoined to the category VP.[17] It would be inconsistent to analyze *ook* as part of a novel lexical item *ikook*, since the same pattern is reported for the equivalent form *auch* in child German. Similarly, the novel use of the emphatic pronoun *ikke* is analyzed as an instance of the pronoun *ik* plus the phoneme *∂*; where *∂* is a proto-morphological place-holder for the verb *want* as in 21 and 22 above.[18] Under this analysis, the phrase markers in 23 a and b below are possible.

23. a. α =ModP

α ={β, ook}β = XP

b. β = VP

α ={β, ook} β =VP

The phrase marker in 23a is more accurate than 23b as *ik+ook* and *ikke* appear with a variety of complements: nonfinite verbs (as in 18) and direct objects (as in 19-22). If the only complement type was VP, then 23b would be preferable. The phrase marker in 23a, yields two possibilities for the next application of Merge with the lexical item *ik* (as in 24 below).

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[15]As the ball and the pen are things which the child wants, *ook* is glossed as *want* by vanKampen as in 20a and b.

[16]Again vanKampen notes: "Maybe some of these ikke = ik wil".

[17]Similar to Hoekstra & Jordens' analysis of *kannie* and *magnie* as discussed above in 4.3.

[18]Tracy, Penner, and Weissenborn note that at the same time that *auch* 'appears in complementary distribution with finite verbs, it often alternates with a morphological place-holder *ä* for the verb 'want'.

24. a. α = IkP

α= ik [+modal] β ={β, ook}

b. β = ModP

α = ik β ={β, ook} [+modal]

Given these two alternatives, 24b is preferable as a ModP is closer to the adult category IP. If the correct phrase marker were 24a (where the head of the projection is *ik*) then we predict a number of different complements (i.e. nominal (e.g. *ik ball* 'I ball') as well as verbal (e.g. *ik wil* 'I want')) to appear with *ik*. This pattern is unattested. Only *ikke* appears string adjacent to nouns (as in 22), never *ik*.[19]

7. Conclusions

7.1 Advantages of Merge

I have argued that the unitary operation of Merge should be adopted instead of Projection or Adjunction (or both). Merge has superior empirical coverage (as demonstrated above) allowing for childrens' novel and adult uses of lexical items. In addition, it is conceptually more parsimonious to have just one phrase structure operation for both adult and child grammars.

7.2 Open Questions for Merge

What is σ?

The choice of the node label of γ seems to be more constrained than Chomsky's definition "the label is either α or β" suggests. In this analysis, the component of the child's utterance which manifests a certain consistency projects. For example, in 23a above (repeated here as 25), the feature of α (a novel modality marker e.g. *ook*) has a constant position and semantics; whereas β is any number of complements {NP, VP, or nothing}.

25. α = ModP

α = [+modal] {β, ook} β = XP {NP, VP, 0}

In 24b, even though α is invariably the lexical item *ik*, it is the incomplete feature matrix of β [+modal] which projects to define the node label σ as in 26 below.

26. β = ModP

α = ik β = [+modal]

As either α or β can be underspecified, it is the category with more constant properties which designates σ.

Detectable Development?

Recall that in Roeper's version of Merge, the child's transition to the adult grammatical representation consists of adding features to the phrase marker. Is there any way to detect this further specification of a UMP which turns it into an AMP as in 27 below?

27. β =ModP ----------> IP

α = ik β ={β, ook} [+modal] α= subject β = IP

[19]Powers (in preparation) finds that out of 3,670 instances of the pronoun *ik* produced by five Dutch children, only one child ever used *ik* directly adjacent to a noun. This occurred only three times.

Presumably, the only way to tell when this feature specification has occurred is by the non-appearance (or the gradual decline) of these novel structures.

Roper claims that that merge structures can "capture neglected moments in acquisition." I maintain that these moments are not only neglected but in fact, are often **undetected**. For example, the novel use of *ikke* and *ook* in child Dutch discussed above, was only discovered after a very careful examination of diary data. If the transition to the adult phrase marker depends on the gradual addition and revision of features of lexical items, then perhaps it is only in detailed data of this sort which adequately reflects such subtle changes.

7.3 Merge in Child Grammars

The version of Merge developed in this paper permits all child utterances to be mapped to phrase markers. A syntactic structure is created whether the child knows all the features of a lexical item or just a subset thereof. This is an advantage over previous theories of children's syntax in which representations are built up independently of the lexical items of which they are composed. Moreover, truly novel child utterances which fell outside the realm of syntactic explanation are naturally accounted for.

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